

Preoperative Cardiac Evaluation Prior to Noncardiac Surgery

Carmine D'Amico, D.O.

Preoperative Cardiac Evaluation

Overview

- **Learning objectives**
- **Introduction**
- **Procedure risk categorization**
- **Preoperative estimation of cardiac risk**
- **Stepwise approach to preoperative evaluation**
- **Preoperative cardiac testing**
- **Procedure timing**
- **Summary**

Preoperative Cardiac Evaluation

Abbreviations

- **ACC: American College of Cardiology**
- **AHA: American Heart Association**
- **ASA : American Society of Anesthesiologists**
- **NICE: National Institute for Health and Care Excellence**
- **MACE: Major adverse cardiac event(s)**

(cont.)

Preoperative Cardiac Evaluation

Abbreviations (cont.)

- **RCRI: Revised Cardiac Risk Index**
- **ACS NSQIP: American College of Surgeons National Surgical Quality Improvement Program**
- **ACS: Acute coronary syndrome**
- **PCI: Percutaneous coronary intervention**
- **DAPT: Dual antiplatelet therapy**

Preoperative Cardiac Evaluation

Learning Objectives

1. List patient characteristics that increase risk of perioperative MACE.
2. Categorize procedures into high-risk or non-high risk.
3. Estimate individual patients' cardiac risk using the RCRI.
4. Estimate individual patients' cardiac risk using the ACS NSQIP online risk calculator.

(cont.)

Preoperative Cardiac Evaluation

Learning Objectives (cont.)

5. Discuss optimal timing of elective noncardiac surgery after ACS or PCI.

Introduction

- **> 50 million surgeries in the US annually**
- **1.4 – 3.9% of surgeries in the US are complicated by a major perioperative cardiac event**
- **Cardiac complications are the most common cause of postoperative morbidity and mortality**
- **Two major determinants of surgical outcomes:**
 - Procedure type
 - Patient characteristics

Procedure risk

2014 ACC/AHA Guidelines divide procedures into only two categories:

- **Low:**
 - Procedure wherein the combined surgical and patient characteristics predict a risk of MACE $< 1\%$
 - e.g. cataract surgery, endoscopy
- **Elevated:**
 - Procedure wherein the combined surgical and patient characteristics predict a risk of MACE $\geq 1\%$
 - e.g. open and vascular procedures

Preoperative Cardiac Evaluation

Preoperative cardiac risk estimation

ACC/AHA recommends use of one of the following cardiac risk estimation tools:

- **Revised Cardiac Risk Index (RCRI)**
- **ACS NSQIP Surgical Risk Calculator**

Revised Cardiac Risk Index⁷

Two or more of the following risk factors make a patient "high risk."

High-risk surgery (intra-abdominal, intrathoracic, or supra-inguinal vascular procedures)

History of ischemic heart disease

History of congestive heart failure

History of cerebrovascular disease

Preoperative treatment with insulin

Preoperative serum creatinine >2.0 mg/dL

Preoperative risk estimation (cont.)


ACS NSQIP Surgical Risk Calculator:

- 22 questions (about patient (including ASA class) and planned procedure)
- Online: <http://riskcalculator.facs.org/>


Preoperative risk estimation (cont.)

ASA Classification:

- 1: Healthy patient
- 2: Mild systemic disease
- 3: Severe systemic disease
- 4: Severe systemic disease / constant threat to life
- 5: Moribund / not expected to survive surgery



Surgical Risk Calculator




AMERICAN COLLEGE OF SURGEONS
Improving Quality. Highest Standards. Better Outcomes.

[Risk Calculator Home Page](#) [About](#) [FAQ](#) [ACS Website](#) [ACS NSQIP Website](#)

Welcome to the ACS NSQIP Surgical Risk Calculator

With this tool you can enter preoperative information about your patient to provide estimates regarding your patient's risk of postoperative complications.

The Risk Calculator is using updated parameters effective July 18, 2017

I'm not a robot
 

I have read the disclaimer and risk calculator permitted use statements below.


Continue

Disclaimer: The ACS Surgical Risk Calculator estimates the chance of an unfavorable outcome (such as a complication or death) after surgery. The risk is estimated based upon information the patient gives to the healthcare provider about prior health history. The estimates are calculated using data from a large number of patients who had a surgical procedure similar to the one the patient may have.


Please note the risk percentages provided to you by the Surgical Risk Calculator are only estimates. The risk estimate only takes certain information into account. There may be other factors that are not included in the estimate which may increase or decrease the risk of a complication or death. These estimates are not a guarantee of results. A complication after surgery may happen even if the risk is low. This information is not intended to replace the advice of a doctor or healthcare provider about the diagnosis, treatment, or potential outcomes. ACS is not responsible for medical decisions that may be made based on the risk calculator estimates, since these estimates are provided for informational purposes. Patients should always consult their doctor or other health care provider before deciding on a treatment plan.

Risk Calculator Permitted Use: An external platform (e.g., an electronic health record) may open the web address of the ACS NSQIP surgical risk calculator in a new browser window. However, we do not permit the calculator to appear as an integrated feature of any external platform, nor do we permit the functionality of the calculator to be automated in any way. The calculator must be presented in its original, unaltered form, maintaining all ACS branding and copyright information.

Step 1 of 4



Surgical Risk Calculator




AMERICAN COLLEGE OF SURGEONS
Improving Quality. Highest Standards. Better Outcomes.

[Risk Calculator Home Page](#) [About](#) [FAQ](#) [ACS Website](#) [ACS NSQIP Website](#)

Welcome to the ACS NSQIP Surgical Risk Calculator

With this tool you can enter preoperative information about your patient to provide estimates regarding your patient's risk of postoperative complications.

The Risk Calculator is using updated parameters effective July 18, 2017

✓ I'm not a robot
 

I have read the disclaimer and risk calculator permitted use statements below.


Continue

Disclaimer: The ACS Surgical Risk Calculator estimates the chance of an unfavorable outcome (such as a complication or death) after surgery. The risk is estimated based upon information the patient gives to the healthcare provider about prior health history. The estimates are calculated using data from a large number of patients who had a surgical procedure similar to the one the patient may have.


Please note the risk percentages provided to you by the Surgical Risk Calculator are only estimates. The risk estimate only takes certain information into account. There may be other factors that are not included in the estimate which may increase or decrease the risk of a complication or death. These estimates are not a guarantee of results. A complication after surgery may happen even if the risk is low. This information is not intended to replace the advice of a doctor or healthcare provider about the diagnosis, treatment, or potential outcomes. ACS is not responsible for medical decisions that may be made based on the risk calculator estimates, since these estimates are provided for informational purposes. Patients should always consult their doctor or other health care provider before deciding on a treatment plan.

Risk Calculator Permitted Use: An external platform (e.g., an electronic health record) may open the web address of the ACS NSQIP surgical risk calculator in a new browser window. However, we do not permit the calculator to appear as an integrated feature of any external platform, nor do we permit the functionality of the calculator to be automated in any way. The calculator must be presented in its original, unaltered form, maintaining all ACS branding and copyright information.

Step 1 of 4



Surgical Risk Calculator



AMERICAN COLLEGE OF SURGEONS
Improving Quality. Highest Standards. Better Outcomes.

[Risk Calculator Home Page](#) | [About](#) | [FAQ](#) | [ACS Website](#) | [ACS NSQIP Website](#)

Enter Patient and Surgical Information

Procedure


Begin by entering the procedure name or CPT code. One or more procedures will appear below the procedure box. You will need to click on the desired procedure to properly select it. You may also search using two words (or two partial words) by placing a "+" in between, for example: "Subtotal colectomy + cholangiography"

Are there other potential appropriate treatment options? Other Surgical Options Other Non-operative options None


Please enter as much of the following information as you can to receive the best risk estimates. A rough estimate will still be generated if you cannot provide all of the information below.

<p>Age Group <input type="text" value="Under 65 years"/></p> <p>Sex <input type="text" value="Female"/></p> <p>Functional Status <input type="text" value="Independent"/></p> <p>Emergency Case <input type="text" value="No"/></p> <p>ASA Class <input type="text" value="Healthy patient"/></p> <p>Steroid use for chronic condition <input type="text" value="No"/></p> <p>Aspirin within 30 days prior to surgery <input type="text" value="No"/></p> <p>Systemic Sepsis within 48 hours prior to surgery <input type="text" value="None"/></p> <p>Ventilator Dependent <input type="text" value="No"/></p> <p>Disseminated Cancer <input type="text" value="No"/></p>	<p>Diabetes <input type="text" value="No"/></p> <p>Hypertension requiring medication <input type="text" value="No"/></p> <p>Congestive Heart Failure in 30 days prior to surgery <input type="text" value="No"/></p> <p>Dyspnea <input type="text" value="No"/></p> <p>Current Smoker within 1 Year <input type="text" value="No"/></p> <p>History of Severe COPD <input type="text" value="No"/></p> <p>Dialysis <input type="text" value="No"/></p> <p>Acute Renal Failure <input type="text" value="No"/></p> <p>BMI Calculation:</p> <p>Height: <input type="text" value=""/> in / <input type="text" value=""/> cm</p> <p>Weight: <input type="text" value=""/> lb / <input type="text" value=""/> kg</p>
--	---

Step 2 of 4



Surgical Risk Calculator



AMERICAN COLLEGE OF SURGEONS
Improving Quality. Highest Standards. Better Outcomes.

[Risk Calculator Home Page](#) | [About](#) | [FAQ](#) | [ACS Website](#) | [ACS NSQIP Website](#)

Enter Patient and Surgical Information

Procedure

Begin by entering the procedure name or CPT code. One or more procedures will appear below the procedure box. You will need to click on the desired procedure to properly select it. You may also search using two words (or two partial words) by placing a "+" in between, for example: "Subtotal colectomy + cholangiography"

Are there other potential appropriate treatment options? Other Surgical Options Other Non-operative options None

Please enter as much of the following information as you can to receive the best risk estimates. A rough estimate will still be generated if you cannot provide all of the information below.

<p>Age Group <input type="text" value="Under 65 years"/></p> <p>Sex <input type="text" value="Female"/></p> <p>Functional Status <input type="text" value="Independent"/></p> <p>Emergency Case <input type="text" value="No"/></p> <p>ASA Class <input type="text" value="Severe systemic disease"/></p> <p>Steroid use for chronic condition <input type="text" value="No"/></p> <p>Aspirin within 30 days prior to surgery <input type="text" value="No"/></p> <p>Systemic Sepsis within 48 hours prior to surgery <input type="text" value="None"/></p> <p>Ventilator Dependent <input type="text" value="No"/></p> <p>Disseminated Cancer <input type="text" value="No"/></p>	<p>Diabetes <input type="text" value="Oral"/></p> <p>Hypertension requiring medication <input type="text" value="Yes"/></p> <p>Congestive Heart Failure in 30 days prior to surgery <input type="text" value="No"/></p> <p>Dyspnea <input type="text" value="With Moderate exertion"/></p> <p>Current Smoker within 1 Year <input type="text" value="Yes"/></p> <p>History of Severe COPD <input type="text" value="No"/></p> <p>Dialysis <input type="text" value="No"/></p> <p>Acute Renal Failure <input type="text" value="No"/></p> <p>BMI Calculation:</p> <p>Height: <input type="text" value="62"/> in / <input type="text" value="161"/> cm</p> <p>Weight: <input type="text" value="178"/> lb / <input type="text" value="79"/> kg</p>
--	---

Step 2 of 4

Enter Patient and Surgical Information

Procedure Clear

47605 - Cholecystectomy; with cholangiography

Begin by entering the procedure name or CPT code. One or more procedures will appear below the procedure box. You will need to click on the desired procedure to properly select it. You may also search using two words (or two partial words) by placing a "+" in between, for example: "cholecystectomy + cholangiography"

Reset All Selections

Are there other potential appropriate treatment options? Other Surgical Options Other Non-operative options None

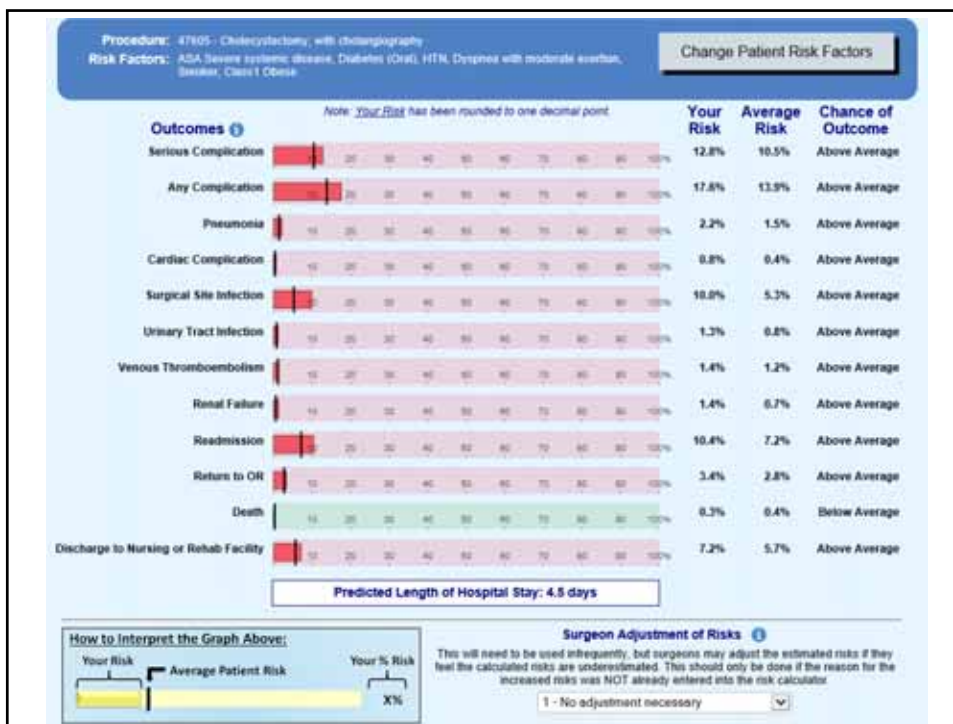
Please enter as much of the following information as you can to receive the best risk estimates. A rough estimate will still be generated if you cannot provide all of the information below.


<p>Age Group</p> <p>Under 65 years</p> <p>Sex</p> <p>Female</p> <p>Functional Status</p> <p>Independent</p> <p>Emergency Case</p> <p>No</p>	<p>Diabetes</p> <p>Oral</p> <p>Hypertension requiring medication</p> <p>Yes</p> <p>Congestive Heart Failure in 30 days prior to surgery</p> <p>No</p> <p>Dyspnea</p> <p>With Moderate exertion</p>
---	--

<p>ASA Class</p> <p>Severe systemic disease</p> <p>Steroid use for chronic condition</p> <p>No</p> <p>Ascites within 30 days prior to surgery</p> <p>No</p> <p>Systemic Sepsis within 48 hours prior to surgery</p> <p>None</p> <p>Ventilator Dependent</p> <p>No</p> <p>Disseminated Cancer</p> <p>No</p>	<p>Current Smoker within 1 Year</p> <p>Yes</p> <p>History of Severe COPD</p> <p>No</p> <p>Dialysis</p> <p>No</p> <p>Acute Renal Failure</p> <p>No</p> <p>BMI Calculation:</p> <p>Height: 62 in / 157 cm</p> <p>Weight: 175 lb / 79 kg</p>
--	--


Back
Continue
Step 2 of 4

© 2007 - 2017, American College of Surgeons National Surgical Quality Improvement Program. All Rights Reserved.





Surgical Risk Calculator



[Risk Calculator Home Page](#)
[About](#)
[FAQ](#)
[ACS Website](#)
[ACS NSQIP Website](#)

Create a report to keep: Select how you would like to get the report.

I would like my report:
(You may select both options)

E-mailed to me

Save or Print Report (PDF)

Patient Name (Optional):

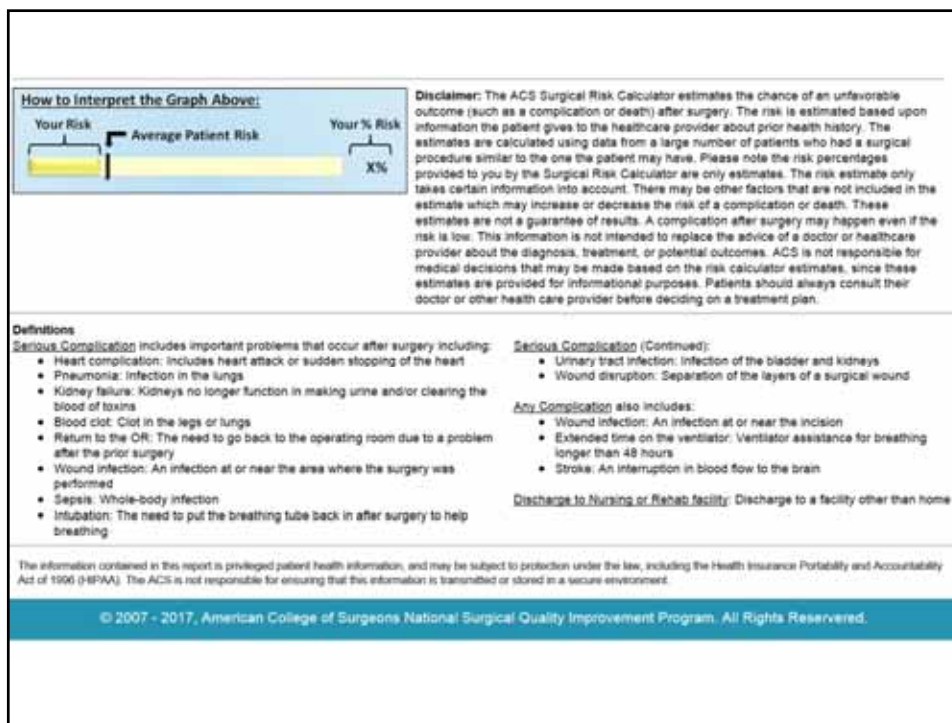
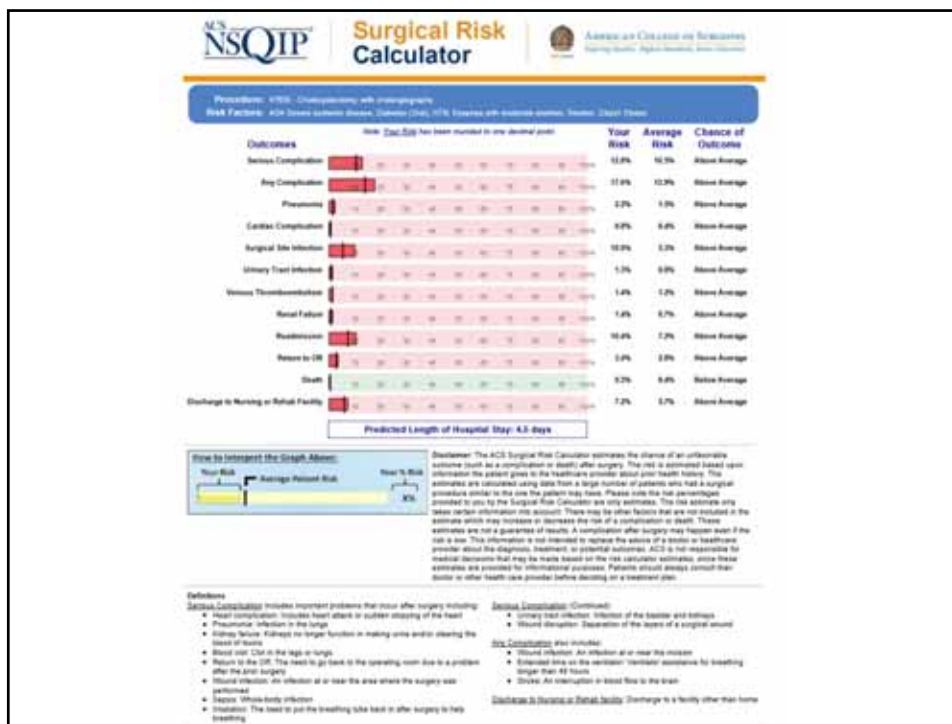
The report will take a few seconds to create. Please be patient.

Finish

Disclaimer:
The information contained in this report is privileged patient health information, and may be subject to protection under the law, including the Health Insurance Portability and Accountability Act of 1996 (HIPAA). The ACS is not responsible for ensuring that this information is transmitted or stored in a secure environment.

Back
Step 4 of 4

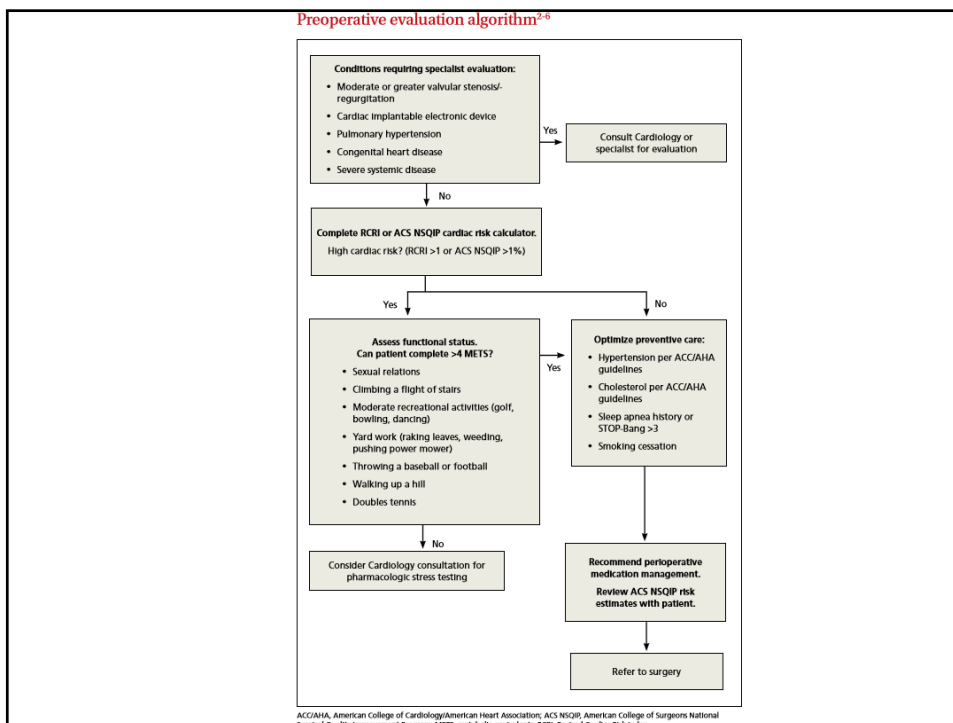
© 2007 - 2017, American College of Surgeons National Surgical Quality Improvement Program. All Rights Reserved.



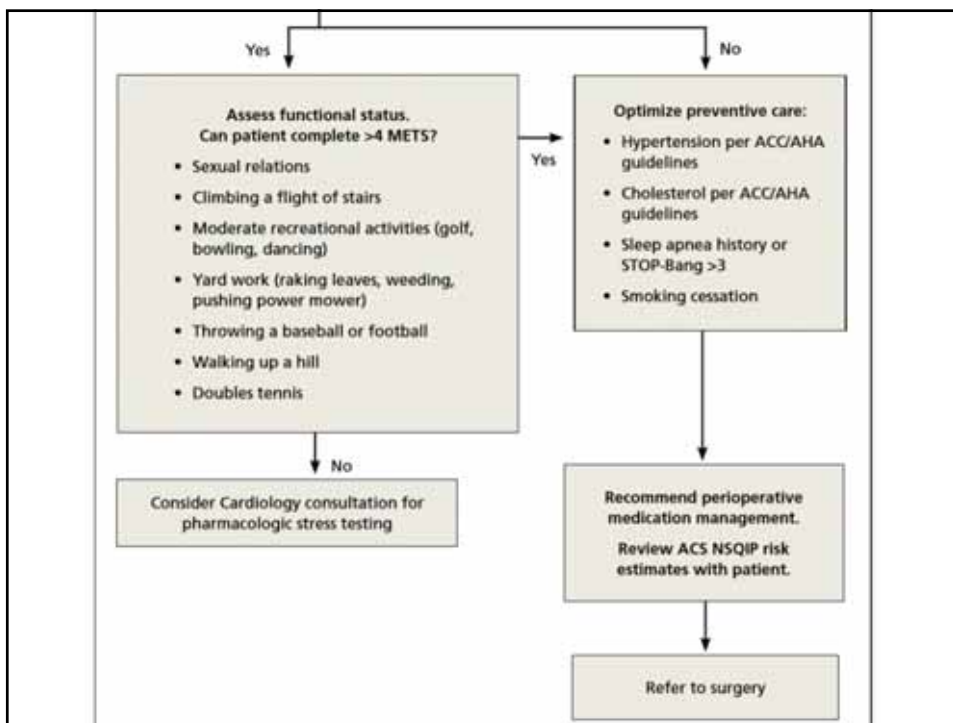
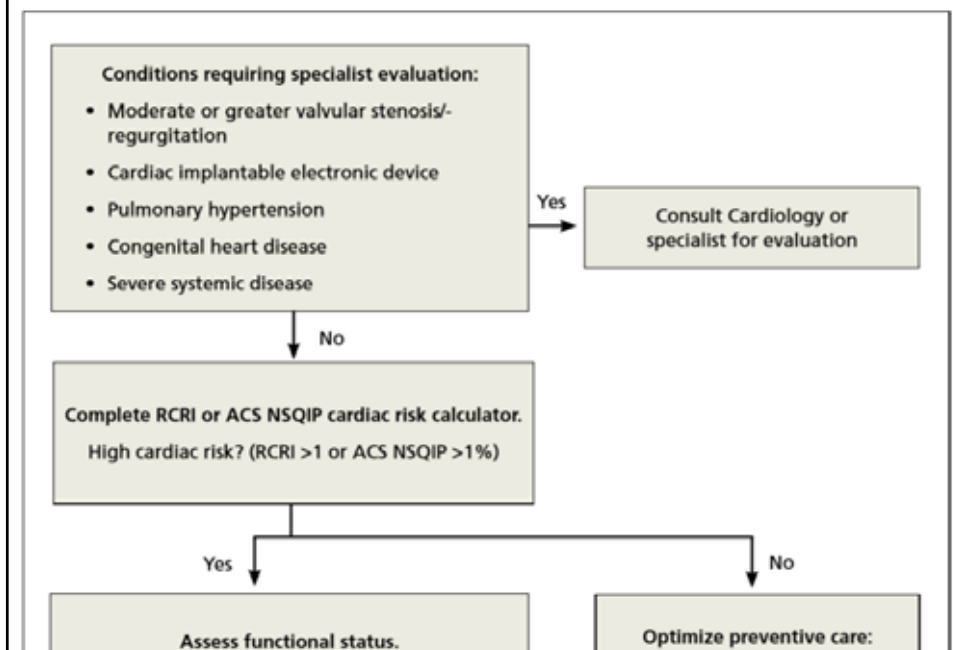
Preoperative Cardiac Evaluation

Stepwise preoperative evaluation

Once the patient's perioperative risk for MACE has been estimated using one of the preceding methods, this information can be used in one of the following algorithms:

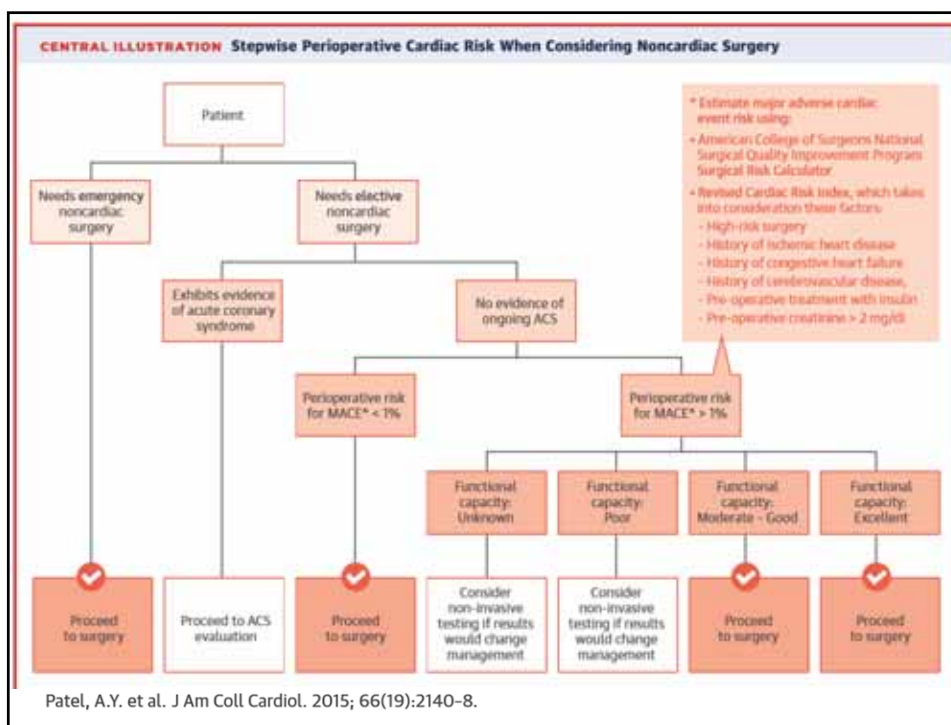


Preoperative evaluation algorithm²⁻⁶



STOP-Bang screening tool for obstructive sleep apnea⁴

S	Snoring	
T	Tiredness	
O	Observed apnea	
P	High blood pressure	
B	Body mass index >35 kg/m ²	
A	Age >50 years	
N	Neck circumference >40 cm	
G	Male gender	
Scoring:	0-3	Low risk
	4+	High risk



Preoperative Cardiac Evaluation

Preoperative cardiac testing

ACC/AHA recommends *against* using the following cardiac tests in the following situations (class III):

- **12-lead EKG**
 - Routine preoperative EKG is *not* useful for asymptomatic patients undergoing low risk procedures.
- **Assessment of left ventricular (LV) function**
 - Routine preoperative evaluation of LV function is *not* recommended.

(cont.)

Preoperative Cardiac Evaluation

Preoperative cardiac testing (cont.)

ACC/AHA recommends *against* using the following cardiac tests in the following situations (class III):

- **Exercise or pharmacologic stress testing**
 - Routine stress testing is *not* useful for patients at low perioperative risk for MACE
 - Routine stress testing is *not* useful for patients undergoing low-risk procedures
- **Preoperative coronary angiography**
 - Routine preoperative coronary angiography is *not* recommended

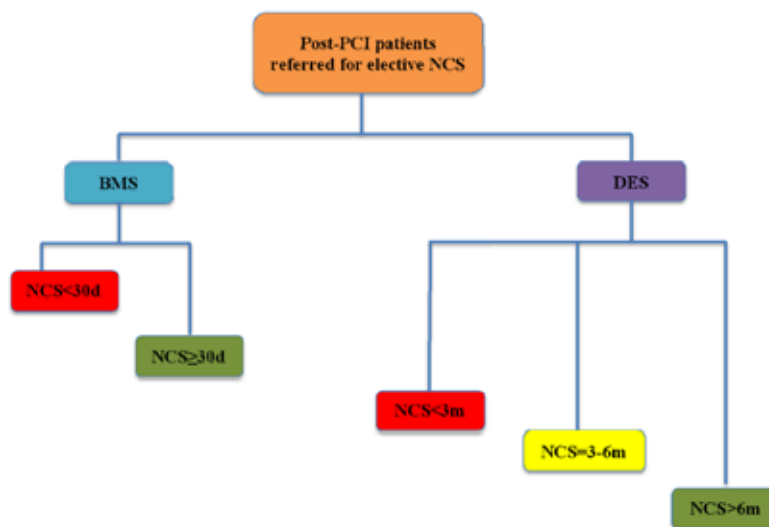
Preoperative Cardiac Evaluation

Procedure timing

Elective noncardiac surgery should be delayed following:

- **ACS**
 - **2014 ACC/AHA Guidelines: minimum 60 day interval between ACS and elective noncardiac surgery.**
- **PCI**
 - **Recommended time delay depends on presence and type of stent implanted.**

Supplemental Figure 1: Guideline Recommendations On Timing of Non-cardiac Surgery Post-PCI



PCI: percutaneous coronary intervention; NCS: non-cardiac surgery and procedures; BMS: bare-metal stents; DES: drug-eluting stents; d: days; m: months. Figure adapted from 2016 ACC/AHA Guideline Focused Update on Duration of Dual Antiplatelet Therapy in Patients With Coronary Artery Disease. Green color box indicates class III guideline recommendation or harm, yellow indicates IIb and green indicates class I recommendation.

Preoperative Cardiac Evaluation

Summary

- **Estimation of patients' cardiac risk is a key component of preoperative evaluation prior to elective noncardiac surgery.**
- **Patients undergoing low-risk procedures usually do not require preoperative cardiac testing.**
- **Patients at low-risk for MACE (as determined by the RCRI or the ACS NSQIP Surgical Risk Calculator) may proceed with surgery without further cardiac testing.**
- **Elective noncardiac surgery should be delayed following ACS and/or PCI.**

Preoperative Cardiac Evaluation

References

1. **Arnold MJ, Beer J. Preoperative evaluation: a time-saving algorithm. J Fam Pract 2016;65(10):702-10.**
2. **Banerjee S, Angiolillo DJ, Boden WE, et.al. Use of Antiplatelet Therapy/ DAPT for Post-PCI Patients Undergoing Noncardiac Surgery. J Am Coll Cardiol 2017;69(14):1861–70; doi: 10.1016/j.jacc.2017.02.012.**
3. **Cohen ME, Ko CY, Bilimoria KY, et.al. Optimizing AS NSQIP modeling for evaluation of surgical quality and risk: patient risk adjustment, procedure risk adjustment, shrinkage adjustment, and surgical focus. J Am Coll Surg 2013; 217:336-46.e1.**
4. **Dakik HA, Kobrossi S, Tamim H. The yield of routine pre-operative cardiovascular evaluation in stable patients scheduled for elective non-cardiac surgery. International J Cardiol 2015;186:325-7.**

(cont.)

Preoperative Cardiac Evaluation

References (cont.)

5. Fleisher LA, Fleischmann KE, Auerbach AD, Barnason SA, Beckman JA, Bozkurt B, Davila-Roman VG, Gerhard-Herman MD, Holly TA, Kane GC, Marine JE, Nelson MT, Spencer CC, Thompson A, Ting HH, Uretsky BF, Wijeyesundera DN. 2014 ACC/AHA guideline on perioperative cardiovascular evaluation and management of patients undergoing noncardiac surgery: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. *J Am Coll Cardiol* 2014;64:e77–137.
6. Lee TH, Marcantonio ER, Mangione CM, et al. Derivation and prospective validation of a simple index for prediction of cardiac risk of major noncardiac surgery. *Circulation*. 1999;100: 1043-1049.

(cont.)

Preoperative Cardiac Evaluation

References (cont.)

7. Levine GN, Bates ER, Bittl JA, Brindis RG, Fihn SD, Fleisher LA, Granger CB, Lange RA, Mack MJ, Mauri L, Mehran R, Mukherjee D, Newby LK, O’Gara PT, Sabatine MS, Smith PK, Smith SC Jr. 2016 ACC/AHA guideline focused update on duration of dual antiplatelet therapy in patients with coronary artery disease: a report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines: an update of the 2011 ACCF/AHA/SCAI guideline for percutaneous coronary intervention, 2011 ACCF/AHA guideline for coronary artery bypass graft surgery, 2012 ACC/AHA/ACP/AATS/PCNA/SCAI/STS guideline for the diagnosis and management of patients with stable ischemic heart disease, 2013 ACCF/AHA guideline for the management of ST-elevation myocardial infarction, 2014 ACC/AHA guideline for the management of patients with non-ST-elevation acute coronary syndromes, and 2014 ACC/AHA guideline on perioperative cardiovascular evaluation and management of patients undergoing noncardiac surgery. *J Am Coll Cardiol* 2016;68:1082–115; <http://dx.doi.org/10.1016/j.jacc.2016.03.513>.

Preoperative Cardiac Evaluation

References (cont.)

8. O'Neill F, Carter E, Pink N, Smith I. Routine preoperative tests for elective surgery: summary of updated NICE guidance. *BMJ* 2016; 353:i3292 doi 10.1136/bmj.i3292.
9. Patel AY, Eagle KA, Vaishnava P. Cardiac Risk of Noncardiac Surgery. *J Am Coll Cardiol* 2015;66(19):2140-8.